thermally coupling a loop heat pipe between the remotely-located heat source and the heat dissipating system; and

coupling heat generated by the remotely-located heat source to the heat dissipating system by way of the loop heat pipe.

6. The method recited in Claim 5 wherein the loop heat pipe comprises flexible thin walled tubing coupled between an evaporator that is thermally coupled to the remotely-located heat source and a condenser that is thermally coupled to heat dissipating system.

REMARKS

Regarding the status of the present application, Claims 1-6 have been amended and are pending in this application. Reconsideration of this application is respectfully requested.

The drawings were objected to because, in the Examiner's opinion, reference characters "10", "14" and "15" have been used to designate at least two different devices. The undersigned attorney apologizes for these errors. The specification and drawings have been amended in a manner that addresses the Examiner's issues. However, it is respectfully submitted that reference numeral "15" is not used to designate more than one component. Reference numeral "15" is used in the specification to designate "flexible thin walled tubing 15" comprising "a loop heat pipe transport line 15", "thin walled tubing 15", and "flexible tubing 15". These alternative recitations refer to the same component. It is respectfully submitted that reference numeral "15" is not used to designate any other component. Enclosed herewith are amended drawing figures containing proposed amendments marked in red ink. Also enclosed is a set of replacement reproducing masters having the amendments included therein. Entry of the amended drawings and replacement reproducing masters is respectfully requested.

The specification was objected to as failing to provide clear support for the claim terminology. The Examiner indicated that "the term "heat dissipating apparatus" does not appear in the specification." Claim 1 has been amended to recite "a heat dissipating system" instead of "heat dissipating apparatus". Accordingly, it is respectfully submitted that the specification provides clear support for the terminology recited in the claims. Accordingly, withdrawal of the Examiner's objection is respectfully requested.

Claims 1 and 2 were rejected under 35 U.S.C. § 112, second paragraph, as being indefinite for failing to particularly point out and distinctly claim the subject matter which applicant regards as the invention. The Examiner stated that "Regarding claim 1, there is an inconsistency within the claim. The preamble indicates subcombination "for use on a spacecraft..." while the body of the claim there is a positive recital of structure (i.e. spacecraft) indicating combination." The Examiner further stated that "Also in claim 1, the recitation "from heat dissipating apparatus" is indefinite and it is not known if applicant is claiming a heat dissipating apparatus or not."

The Claims have been amended in a manner that addresses the Examiner's issues. It is respectfully submitted that Claims 1-6 have been amended to be clear and definite. Withdrawal of the Examiner's rejection is respectfully requested.

Claims 1-6 were rejected under 35 U.S.C. § 102(b) as being anticipated by U.S. Patent No. 5,743,325 issued to Esposto. The Esposto patent states that it discloses "a closed-loop heat pipe transport design for a deployment application having a flexible section which connects to a payload structure and a deployable structure. The flexible section folds over itself while the deployable structure is stowed. Upon rotation of the deployable structure around a predetermined axis, the flexible section unfolds, with a portion of the flexible section passing through the predetermined axis. When the deployable structure has completed its rotation and is fully deployed, the components of the flexible section will lie in substantially the same plane".

The Esposto patent also states that it discloses "a flexible serpentine-shaped section in a closed-loop heat pipe system to provide a deployable radiator structure to be easily deployed, from a first predetermined position to a second predetermined position with respect to a space-craft. The deployable radiators are located on the exterior of the spacecraft and are coupled to fixed radiators or other spacecraft structures by hinges". The serpentine section is designed to rotate by mean of hinges, as is shown in Fig. 1. The hinging action is shown in Fig. 4.

In contrast to the teachings of the Esposto patent, the present invention provides for heat transfer systems and methods that use a loop heat pipe to transfer heat from a remotely located heat source to a spacecraft thermal radiator or heat dissipating system. This is not disclosed or suggested by the Esposto patent. In the invention, a heat dissipating component is not located on a heat pipe panel and not mounted on a payload radiator. A loop heat pipe is used to transport heat from the remotely located heat dissipating component to the payload radiator or heat pipe panel.

While the Esposto patent mentions that "is an evaporator from which heat from a heat source is absorbed", nothing whatsoever is stated in the Esposto patent regarding the location of the heat source. In particular, there is no disclosure or suggestion in the Esposto patent that the heat source is disposed at a location that is remote from heat dissipating system. Furthermore, there is no disclosure or suggestion in the Esposto patent that the heat source is coupled to the heat dissipating system using a loop heat pipe". The Esposto patent discloses "a closed-loop heat pipe system".

While the Esposto patent states that "The fixed radiator panel will have heat pipes that are in thermal communication with the heat sources within the spacecraft.", it is respectfully submitted that the Esposto patent does not disclose or suggest that the heat sources are coupled to the fixed radiator panel using loop heat pipes, as is provided by the present invention.

Therefore, with regard to Claim 1, it is respectfully submitted that the Esposto patent does not disclose or suggest "a remotely-located heat source disposed on the spacecraft at a location that is remote from heat dissipating system" (i.e., the heat dissipating component is not located on a heat pipe panel or not mounted on a payload radiator) or "a loop heat pipe

thermally coupled between the remotely-located heat source and the heat dissipating system for coupling heat generated by the heat source to the heat dissipating system", as is recited therein. Therefore, it is respectfully submitted that the invention recited in Claim 1 is not disclosed or suggested by the Esposto patent. Accordingly, withdrawal of the Examiner's rejection and allowance of Claim 1 are respectfully requested.

Dependent Claim 2 is considered patentable based upon the allowability of Claim 1. Accordingly, withdrawal of the Examiner's rejection and allowance of Claim 2 are respectfully requested.

Independent Claims 3 and 5 recite limitations that are substantially the same as those recited in Claim 1 and are considered to be patentable for the same reasons argued above with regard to Claim 1. Accordingly, withdrawal of the Examiner's rejection and allowance of Claims 3 and 5 are respectfully requested.

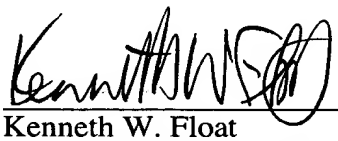
Dependent Claim 4 and 6 are considered patentable based upon the allowability of Claims 3 and 5 from which they depend. Accordingly, withdrawal of the Examiner's rejection and allowance of Claim 4 and 6 are respectfully requested.

Attached hereto is a marked-up version of the changes made to claims by the present amendment. The attached page is captioned "Version with markings to show changes made."

The prior art made of record and not relied upon is considered pertinent to applicant's disclosure to the extent indicated by the Examiner.

In view of the above amendments and arguments, it is respectfully submitted that all pending Claims are not anticipated by, nor are they obvious in view of, the cited reference, and are therefore patentable. Accordingly, it is respectfully submitted that the present application is in condition for allowance. Reconsideration and allowance of this application is respectfully requested.

Respectfully submitted,



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VERSION WITH MARKINGS TO SHOW CHANGES MADE

IN THE SPECIFICATION

The paragraph starting at page 2, line 31 has been amended as follows

Referring to the drawing figures, Fig. 1 is a perspective view of a portion of a spacecraft 20 and illustrates an exemplary heat transfer system [10] 10a, (or heat dissipation system 10a) in accordance with the principles of the present invention. Fig. 2 is a side view of the spacecraft 20 and heat dissipation system [10] 10a shown in Fig. 1.

The paragraph starting at page 2, line 35 has been amended as follows

The spacecraft 20 illustrated in Figs. 1 and 2 comprises an Earth deck 11 that is a transverse panel of the spacecraft 20 on which heat dissipating equipment (heat sources 14) are located. The Earth deck 11 attached to North and South radiator panels 12, 13. Exemplary heat dissipating equipment 14 or heat source 14 is shown as a Ku-band feed horn 14, although there are other heat sources that are located remotely from either of the radiator panels 12, 13, [14,] or from heat dissipating apparatus such as heat pipe panels, RF loads, output multiplexer (OMUX) filters, RF switches and circulators (not shown).

The paragraph starting at page 3, line 6 has been amended as follows

The exemplary heat transfer system [10] 10a comprises a loop heat pipe 10. The loop heat pipe 10 comprises flexible thin walled tubing 15 comprising a loop heat pipe transport line 15 that is coupled between one or more evaporators 17 that are thermally coupled to the heat source 14 (Ku-band feed horn 14) and one or more condensers 16 that are thermally coupled to one or more of the radiator panels 12, 13 [, 14,].

The paragraph starting at page 4, line 6 has been amended as follows

A heat source 14 is disposed 31 on a spacecraft 20 at a location that is remote from a thermal radiator 12, 13. A heat transfer system [10] 10a comprising a loop heat pipe 10 is thermally coupled 32 between the heat source 14 and the thermal radiator 12, 13. Heat generated by the heat source 14 is coupled 33 to the thermal radiator 12, 13 by way of the loop heat pipe 10.

IN THE CLAIMS

The following Claims have been amended as indicated.

1. (Amended) A heat transfer system [for use on a spacecraft having heat dissipating apparatus, the system] comprising:

a spacecraft comprising a heat dissipating system;

a remotely-located heat source disposed on the spacecraft at a location that is remote from heat dissipating [apparatus] system; and

a loop heat pipe thermally coupled between the remotely-located heat source and the heat dissipating [apparatus] system for coupling heat generated by the heat source to the heat dissipating [apparatus] system.

2. (Amended) The [spacecraft radiator] heat transfer system recited in Claim 1 wherein the loop heat pipe comprises flexible thin walled tubing coupled between an evaporator that is thermally coupled to the remotely-located heat source and a condenser that is thermally coupled to the heat dissipating [apparatus] system.

3. A spacecraft comprising:

a heat dissipating [apparatus] system for radiating heat into space;

a remotely-located heat source disposed at a location that is remote from heat dissipating [apparatus] system; and

a loop heat pipe thermally coupled between the remotely-located heat source and the heat dissipating [apparatus] system for coupling heat generated by the remotely-located heat source to the heat dissipating [apparatus] system.

4. The spacecraft recited in Claim 2 wherein the loop heat pipe comprises flexible thin walled tubing coupled between an evaporator that is thermally coupled to the remotely-located heat source and a condenser that is thermally coupled to heat dissipating [apparatus] system.

5. A heat dissipation method for use on a spacecraft comprising the steps of:

disposing a remotely-located heat source on a spacecraft at a location that is remote from a heat dissipating [apparatus] system;

thermally coupling a loop heat pipe between the remotely-located heat source and the heat dissipating [apparatus] system; and

coupling heat generated by the remotely-located heat source to the heat dissipating [apparatus] system by way of the loop heat pipe.

6. The method recited in Claim 5 wherein the loop heat pipe comprises flexible thin walled tubing coupled between an evaporator that is thermally coupled to the remotely-located heat source and a condenser that is thermally coupled to heat dissipating [apparatus] system.

AMENDED

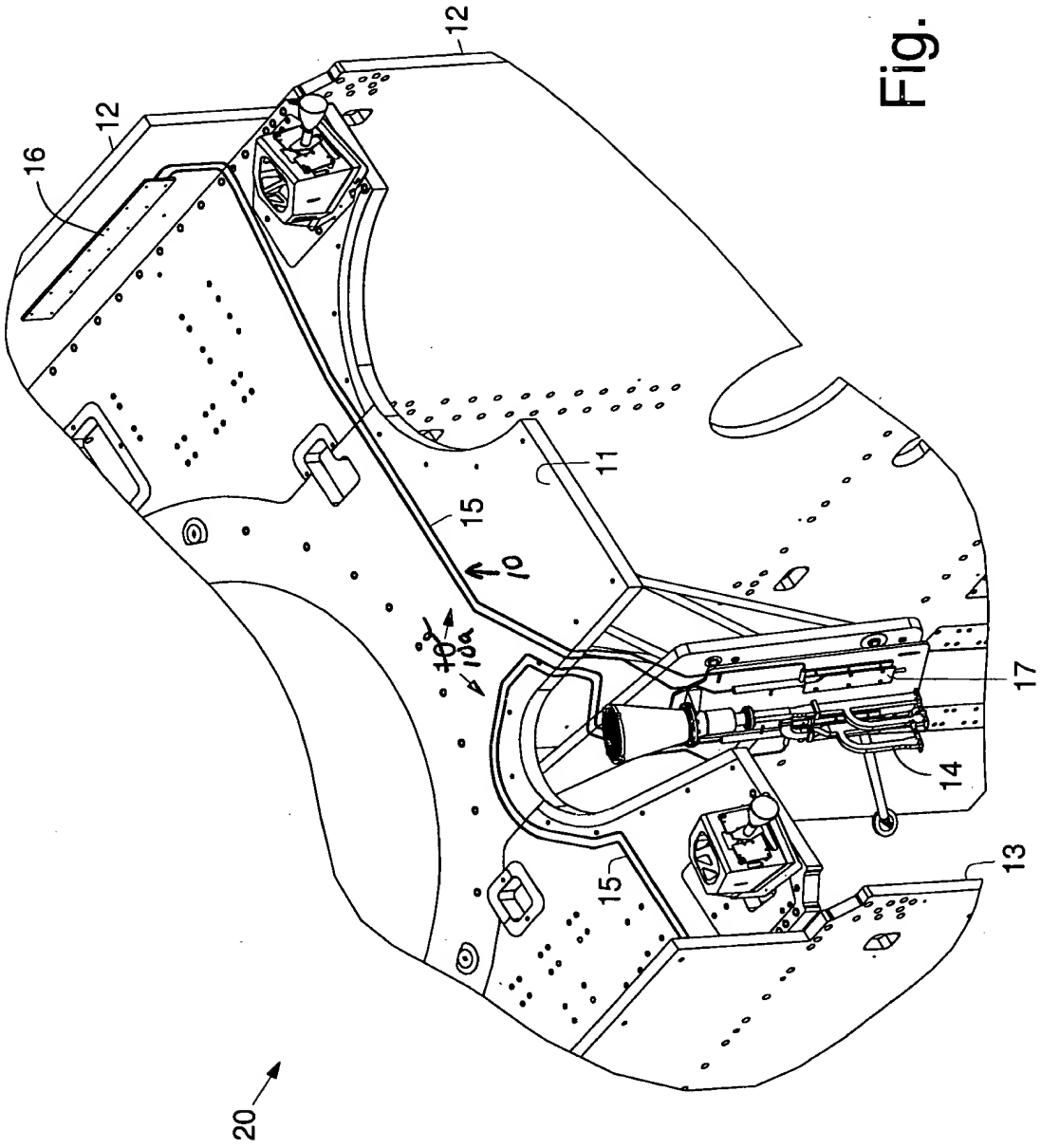

Fig. 1

AMENDED

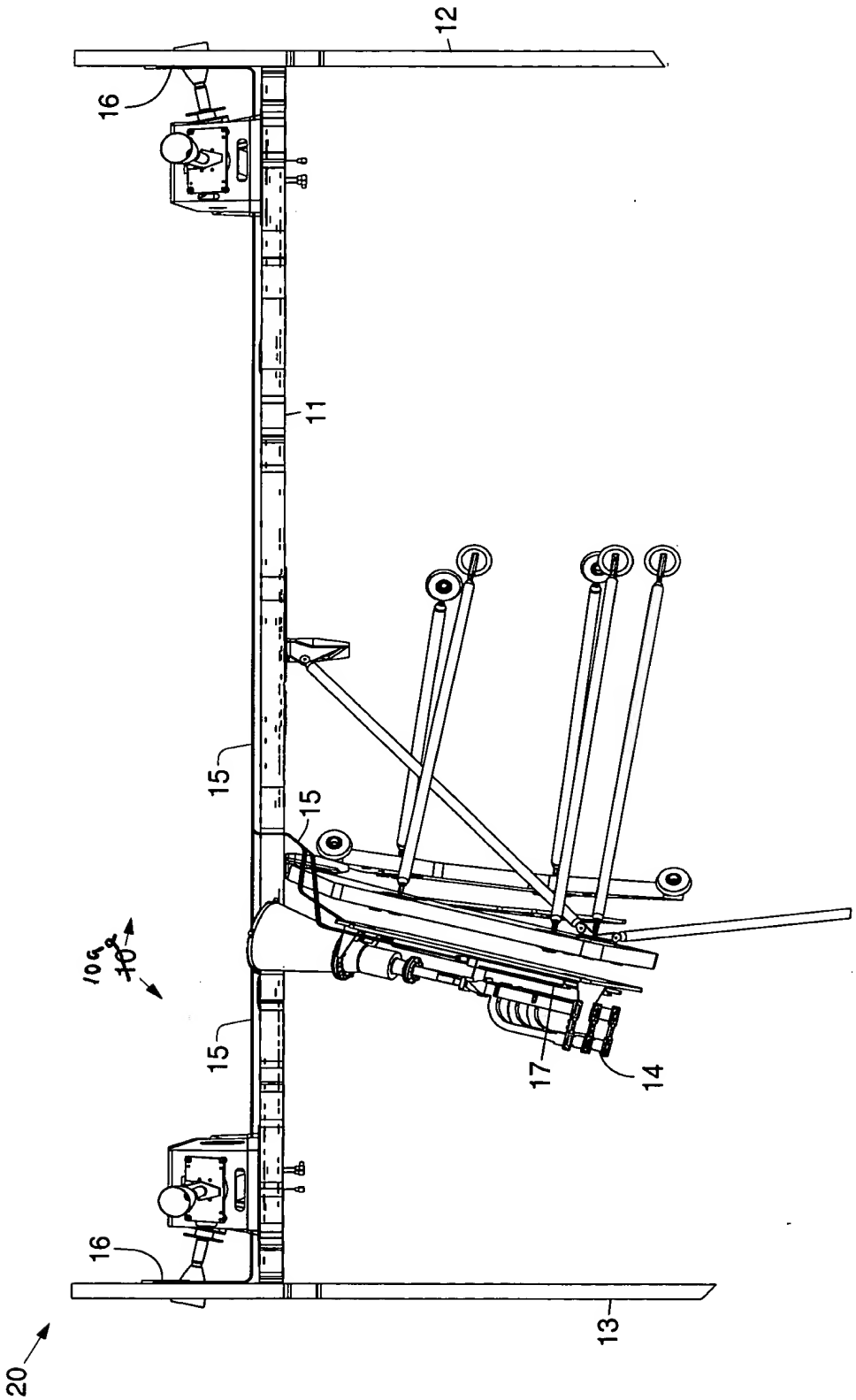

Fig. 2

AMENDED

Fig. 3